

## 3.2 River and Stream Aquatic Life Use Assessment

**Aquatic Life Designated Use Milestone:** By 2005, 50% of assessed nontidal river miles will support healthy, sustainable, biological communities.

Aquatic life designated use support assessments evaluate attainment of Federal and State Surface Water Quality Standards provisions for the protection and propagation of a balanced population of shellfish, fish and wildlife. This assessment and portions of the following discussion are taken directly from NJDEP (1999).

The NJDEP has a wide range of data available to utilize in assessing aquatic life use support including chemical, habitat and biological. USEPA Guidance for the Preparation of Water Quality Inventory Reports strongly emphasizes the use of biological data as the basis for assessing wade-able streams and rivers especially when the data quality is high, as in New Jersey. Therefore, NJDEP evaluated aquatic life designated use support in non-tidal rivers and streams using benthic macroinvertebrate monitoring.

Benthic macroinvertebrate organisms, including crustacea, larval insects, snails and worms, are ubiquitous throughout the state's streams and are an important component of the aquatic food web. These communities integrate the effects of multiple stressors including habitat quality (e.g., temperature, flow, erosion, sedimentation); chemical quality (e.g., contaminants in water and /or sediment) and natural shifts in population. Further, benthic macroinvertebrates may reveal the impacts of chronic stressors which may be overlooked by the short-term "snapshot" view provided by ambient chemical sampling. Thus, benthic data provide a useful indicator to screen the overall health of aquatic communities.

### 3.2.1 River and Stream Aquatic Life Use Assessment Method

Benthic macroinvertebrate communities were examined using USEPA's Rapid Bioassessment Protocols - Level II (see Plafkin, et al, 1989; NJDEP, 1992). Using this protocol, communities are examined for pollution tolerant and intolerant forms and the results are used to compute the New Jersey Impairment Score (NJIS). Using this scoring system, the benthic macroinvertebrate population results were used to identify aquatic life designated use support for monitored stream miles as follows: **full support** (non-impaired), **partial support** (moderately impaired) and **no support** (severely impaired); see Table 3.2.1-1 below.

**Table 3.2.1-1: River and Stream Aquatic Life Use Assessment**

<b>Aquatic Life Use Support Assessment</b>	<b>Rapid Bioassessment Rating</b>
Full Support	Non-Impaired
Partial Support	Moderately Impaired
No Support	Severely Impaired

Currently in New Jersey, monitoring occurs in the Ambient Biological Monitoring Network (AMNET) at over 800 locations statewide on a 5-year rotating schedule. Round 1 sampling was completed in the mid-1990's and the resulting designated use assessment results were reported in

the 1992, 1994, 1996 and 1998 305(b) Reports. Round 2 sampling is now ongoing. For this 2000 Water Quality Inventory Report, published assessments for Round 2 are reported, which includes the Upper Delaware Basin (WMAs 1, 2 and 11) which was sampled between 1997 and 1998 (see Fig. A3.1.2-2). Round 2 data collection for the remaining portions of the state will be completed in 2001 and final reports should be completed in 2002. As Round 2 sampling results are published, they will be reflected in future Water Quality Inventory Reports. Readers are referred to the 1996 or 1998 305(b) Reports for the current status of statewide aquatic life assessment results based upon the first round of sampling. Because the data supporting the Aquatic Life Designated use assessment here are 5 years old or less, they are regarded as monitored.

In addition to direct biological assessments, the current round of field work includes a qualitative assessment of stream habitat quality at each monitoring location, the results of which are used to compute a Habitat Assessment Score. Various components of the habitat are examined such as the amount of available cover along the stream bottom, amount of sediment deposition, bank stability, frequency of riffles, presence and amount of riparian vegetative cover, etc.

**Spatial Extent of Assessment:** In former 305(b) reports, each AMNET site was assumed to represent 5 river miles (2.5 miles upstream and 2.5 downstream) with totals in each assessment category added up accordingly. This approach did not consider hydrology (e.g., the presence of lakes within the 5 mile length) and in fact some stations are less than 5 miles apart.

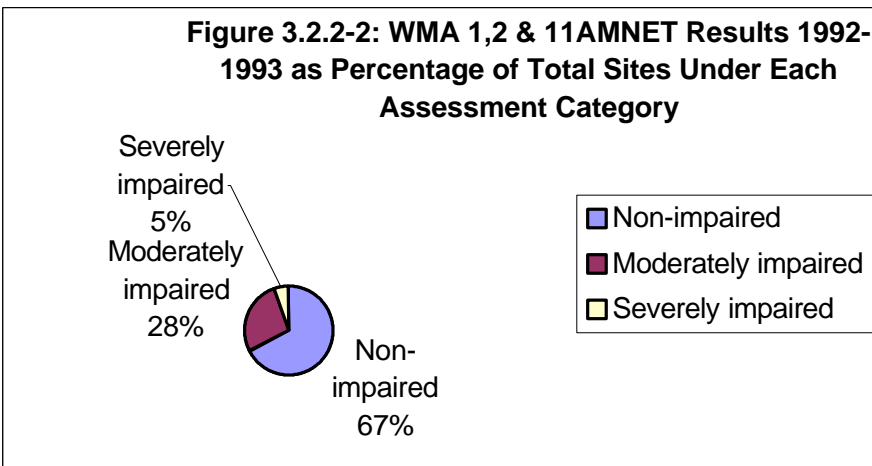
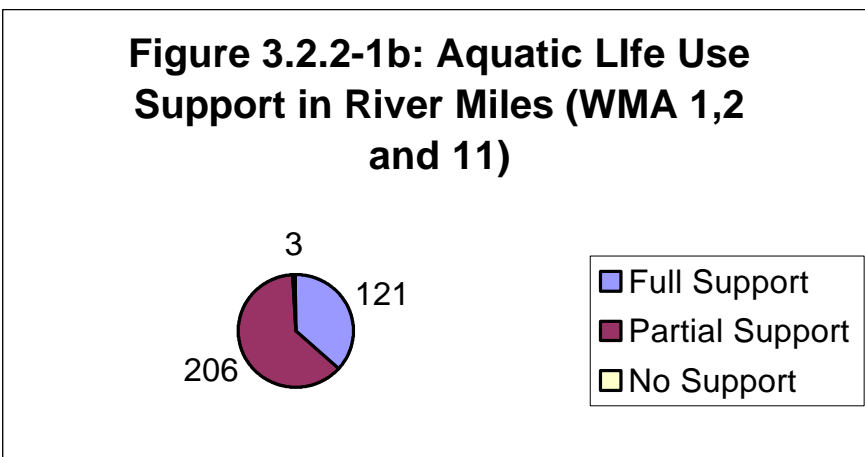
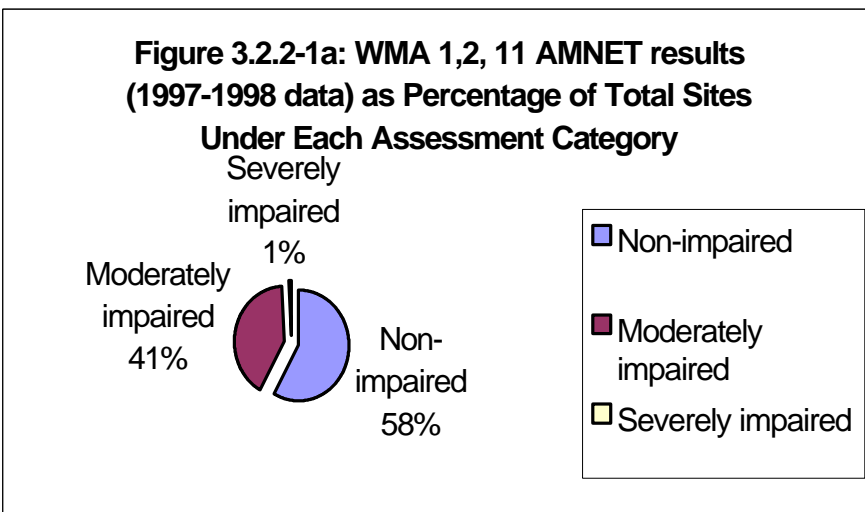
In order to address these issues, river miles assigned to each use support category were determined by assigning the specific AMNET site use assessment to the RF3 river segment containing that site for this report. Hence, if an AMNET site was assessed to be fully supporting and was associated with a 2 mile long RF3 segment, those 2 miles would be assessed as fully supporting. The total river miles fully, partially and not supporting represent the sum of all these RF3 segment lengths associated with AMNET sites which fell into one of the three categories. For this Report, 139 monitoring stations, representing 330 stream miles were assessed.

The current process results in a much smaller number of river miles assessed, while at the same time the use of RF3 coverage to estimate total river miles has somewhat enlarged the estimate of total river miles in the state (See Part 2: Background). As discussed in the Plan for Comprehensive Assessments provided in Part III, Chapter 2, the Department is developing methods to extend assessments determined at individual points such as AMNET sites and extrapolating the observed condition to contiguous portions of the reach not directly assessed. Results will be presented in future 305(b) reports.

### **3.2.2 River and Stream Aquatic Life Use Assessment Results**

Overall, out of 139 monitoring stations sampled in WMAs 1,2 and 11 during the most recent study period, 80 stations or 58% were rated as non-impaired, 57 stations or 41.3% were rated as moderately impaired, and one station (0.7%) was rated as severely impaired (see Figure 3.2.2-1 and Fig. A3.1.2-2). When translated into river miles (using RF3 segment lengths) the results are as follows: of a total of 330 miles assessed; 121 miles (36.7%) fully support the

use, 206 miles (62.4%) partially support the use and 3 miles (1%) do not support the use (see Figure 3.2.2-1b).



### Comparison with 1992 - 1993 AMNET Results

In evaluating the 1997-1998 upper Delaware data against that for 1992-1993, a notable improvement or decline was considered to have occurred when the score (NJIS) changed the bioassessment rating. A complete list of site-by-site comparisons is presented in Table 3.2.2-2, where a (+) indicates an improvement, a (-) indicates a decline, and a (/) indicates no change in rating; a slash accompanied by a (+) or a (-) indicates that the score improved or declined, but the bioassessment rating did not.

For comparison, Figure 3.2.2-1a depicts the results of 139 monitoring sites during the current assessment period (1997-1998) as percentage of the total sites assessed. Figure 3.2.2-2 depicts the results of 127 monitoring sites within the same Watershed Management Areas that were sampled during the 1990 - 1993 study period. Note that Figures 3.2.2-

1a and 3.2.2-2 are based upon number of AMNET sites within each assessment category, not the number of river miles as seen in Figure 3.2.2-1b.

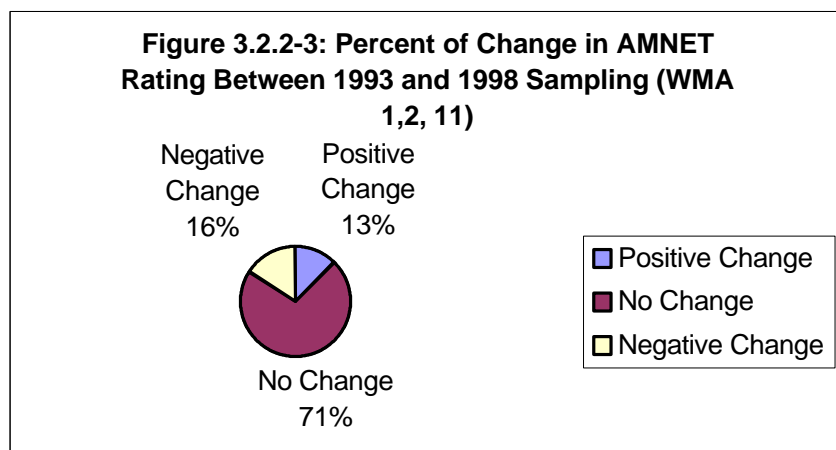


Figure 3.2.2-3 displays the percentage of change in rating that has occurred for the 127 sites that were sampled during both the 1993 and 1998 monitoring efforts. The light gray indicates a positive change, dark gray indicates no change, and white indicates a change for the worse (see Table 3.2.2-2). Notably,

fewer severely impaired sites were found in 1998 than in 1993; however, the 1998 data also revealed more moderately impaired sites and fewer non-impaired sites (Figures 3.2.2-1 & 3.2.2-2). Strategies to identify factors that contribute to impairment and management measures to address impairment are discussed below in Section 3.2.4.

### Results from Finfish Assessments

The US Geological Survey has recently completed an assessment of finfish communities in the Delaware, Passaic and Raritan River Basins (Chang, et al, 2000). This assessment was based on NJDEP and USEPA fish population data. The specific assessment tool employed is an "Index of Biotic Integrity" (IBI) which enumerates characteristics of fish communities such as species composition and ecological structure in order to measure the community's overall health. Comparisons were made between data collected in the 1970s and the 1990s. Conclusions in the Report state that "Although human population and urbanization have increased, higher IBI scores and improvements in stream condition in the Passaic, Raritan, and Delaware River Basins from the 1970s to the 1990s appear to reflect overall improvements in water quality" (pg. 3). Results are illustrated in Figure 3.2.2-4 below and are provided courtesy of the USGS. NJDEP is developing methods of assessing the biological health of New Jersey waters using multimetric methods which would incorporate finfish IBI assessments (discussed here), macroinvertebrates (currently employed), as well as other metrics (see "Next Steps" below).

**Insert better fish map here**

**Figure 3.2.2-4: Summary IBI Scores for the Delaware, Passaic, and Raritan River Basins**  
 Figure obtained courtesy of Jonathan Kennen, US Geological Survey

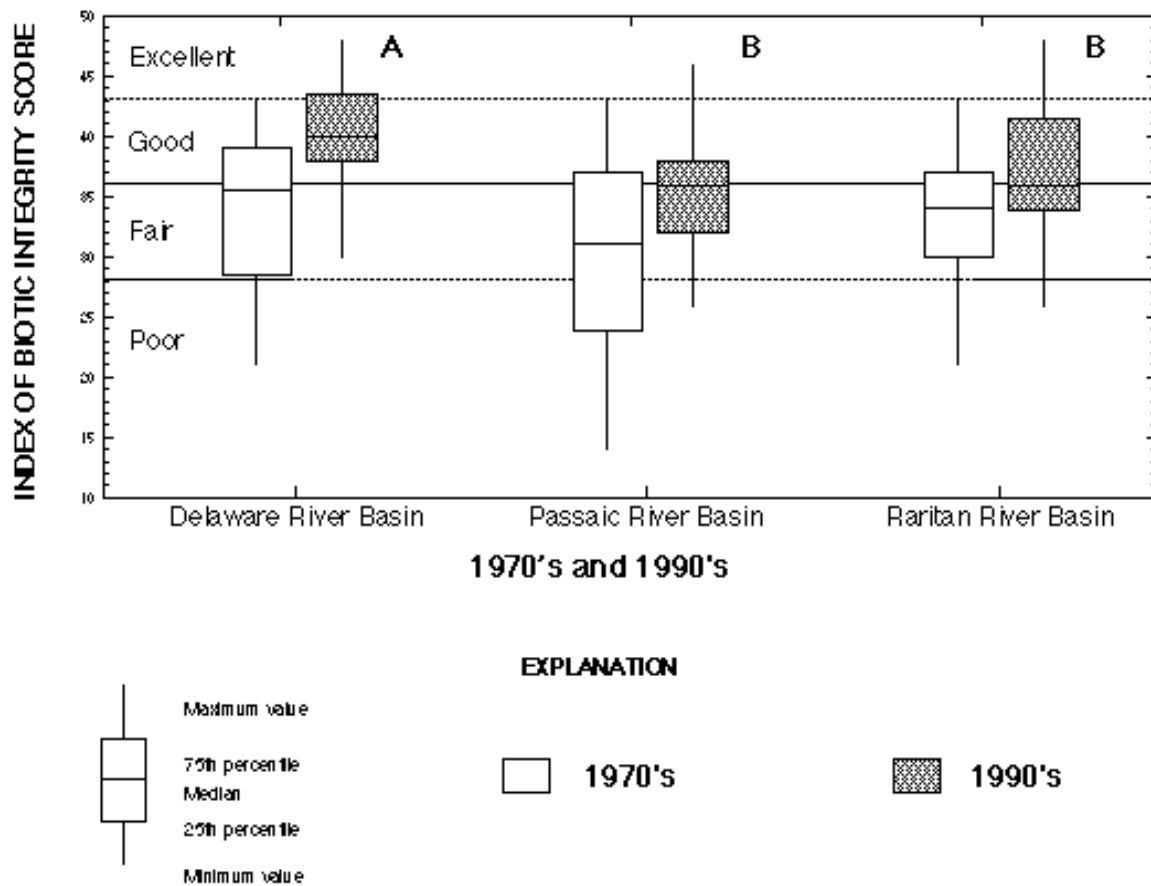


Figure 2

### Recently Adopted Changes in Trout Water Classifications

Over the past several years New Jersey has adopted changes to the Trout Water Classifications of 18 river segments (Table 3.2.2-1 below). Of this total, 16 river segments received upgrades, one was downgraded (TM to NT), and one segment was confirmed in its current classification.

Of the upgrades delineated on Table 3.2.2-1, some may be due to improvements in water quality, however, concurrent water quality data needed to confirm this is as yet not available. Many of the upgrades are the result of additional information gathered in waterbodies whose classifications had been previously defaulted to adjacent segments with confirmed classifications based on monitoring. This is indicated in Table 3.2.2-1 when a previous classification is enclosed within brackets and the current one is bracket-free.

**Table 3.2.2-1: Adopted Trout-Related Reclassifications (1992 to 1996)**

<b>Drainage Basin</b>	<b>Waterbody</b>	<b>Date Sampled</b>	<b>Previous Classification</b>	<b>Current Classification</b>
Atlantic	Clear Stream (Jackson)	7/24/96	FW2-NT	FW2-TM
Delaware R	Paulins Kill trib. (Stillwater)	7/1/92	[FW2-TM]	FW2-TM
Passaic R	Crooked Brook trib. (East of Sheep Hill)	7/20/95	[FW2-NT]	FW2-TP(C1)
Passaic R	Meadow Brook (Wanaque)	8/16/93	FW2-NT	FW2-TP(C1)
Passaic R	Passaic River (Mendham)	8/10/94	FW2-NT	FW2-TP(C1)
Passaic R	Pequannock River (Newfoundland)	7/17/95 & 8/31/95	FW2-TM	FW2-TP(C1)
Passaic R	Scarlet Oak Pond (Mahwah)	8/18/94	[FW2-NT]	FW2-TM
Passaic R	Wanaque River (Pompton Lakes)	8/13/92	FW2-NT	FW2-TM
Raritan R	Drakes Brook trib. (Mt. Olive)	8/16/94	[FW2-NT]	FW2-TP(C1)
Raritan R	Lamington River trib. (Ironia)	9/15/95	[FW2-NT]	FW2-TP(C1)
Raritan R	Mine Brook trib. (East of Mine Mt.)	9/15/95	[FW2-NT]	FW2-TP(C1)
Raritan R	Raritan River - South Branch (Middle Valley)	8/11/95, 8/17/95 & 9/5/95	FW2-TM	FW2-TP(C1)
Raritan R	Mine Brook trib. (South of Mine Mt.)	9/15/95	[FW2-NT]	FW2-TP(C1)

<b>Drainage Basin</b>	<b>Waterbody</b>	<b>Date Sampled</b>	<b>Previous Classification</b>	<b>Current Classification</b>
Raritan R	Raritan River - South Branch trib. (Long Valley)	7/17/96	[FW2-TM]	FW2-TP(C1)
Raritan R	Raritan River - South Branch trib. (S. of Hoffmans)	7/18/96	[FW2-TM]	FW2-TP(C1)
Raritan R	Raritan River - South Branch trib. (S. of Schooley's Mt.)	7/17/96	[FW2-TM]	FW2-TP(C1)
Raritan R	Sidney Brook (Grandin)	7/18/96	[FW2-TM]	FW2-NT
Walkill R	Wallkill River trib. (Sparta)	7/1/92	[FW2-NT]	FW2-TP(C1)
<b>Note:</b> Brackets around a previous classification indicate that the waterbody was not specifically named in the Surface Water Quality Standards and had therefore, by default, assumed the classification given herein.				

### **Other Indicators of Aquatic Life Use Attainment**

As discussed in Part III, Chapter 3.1, dissolved oxygen and un-ionized ammonia are relevant to aquatic life uses: DO is required for most forms of aquatic life and un-ionized ammonia is toxic to aquatic life in elevated concentrations. Based on data collected between 1995 and 1997 in the Ambient Stream Monitoring Network, with few exceptions monitored rivers attain these SWQS criteria, or have water quality better than required by the SWQS.

### **3.2.3 Source and Cause Assessment**

Benthic impairment has been generally attributed to

- water and sediment quality degradation,
- habitat alterations (e.g., erosion, sedimentation),
- flow alterations (decreasing base flow, flashiness) and
- natural factors (drought, population fluctuations).

Often, multiple factors play a role in observed impairments such as multiple ongoing anthropogenic activities in concert with residual contamination from historical point and/ or non-point sources.

Using NJDEP data collected at over 700 sites, USGS evaluated the relationships between watershed characteristics and benthic status (USGS, 1998) and found the following:

- the total area of forest and wetlands in a basin were the best predictor of an unimpaired benthic community
- the amount of urban land in close proximity to a sampling site was the best predictor of an impaired benthic community

- distance from pollution sources to sampling sites was significant.

Through the Long Island - New Jersey National Ambient Water Quality Assessment (LI-NJ NAWQA) program, extensive data collection was conducted at 36 sites, primarily in the Piedmont region of New Jersey. Concentrations of conventionals, volatile organic contaminants, pesticides in water and sediment, fish, algae and benthic populations, habitat quality data were collected. Advanced multi-variate statistics were used to identify factors that may contribute to benthic impairment. Results indicate that peak and base flows, percent cobble in the substrate and impervious surface cover in the upstream watershed were important factors that contribute to benthic impairment. Water and sediment quality were not identified as statistically significant contributing factors to benthic impairment in the LI-NJ NAWQA study area. Additional details will become available as results from the project are published in the near future. (M. Ayers, pers. comm).

### **3.2.4 Maintaining and Improving Aquatic Life Use Attainment**

Currently, about 500 moderately and severely impaired locations are included on the 1998 Impaired Waterbodies List, including those in the Upper Delaware Watersheds. NJDEP and USEPA are jointly developing a protocol to identify factors that contribute to benthic impairment and identify appropriate management strategies. If water quality degradation contributes to impairment, TMDLs will be conducted.

As discussed below, efforts are underway to improve our understanding of the status of aquatic life use attainment, the factors that contribute to impairment and what are appropriate management measures. Through the implementation of Watershed Management, overall improvements in watershed quality are intended to lead to improvements in aquatic health.

Integration of Biological Datasets: NJDEP is expanding biological assessment tools to include fish population data to more comprehensively evaluate biological health using existing fisheries databases and to collect new data. A study is also underway to characterize algal communities and presence of rare and threatened species. Results of these projects will be integrated with benthic assessments to improve aquatic life designated use attainment assessments.

Integration with Water Chemistry Datasets: Dissolved oxygen measurements over a 24 hour cycle (diurnal DO) will be collected to improve this indicator of biological health. The redesigned Ambient Stream Monitoring Network includes water chemistry data at about 115 stations statewide. Many of these stations are co-located with benthic monitoring locations in the AMNET network. Field parameters (DO, pH, Temperature, Specific Conductance) data collected when AMNET stations are sampled are being computerized. NJDEP recently received funding to conduct quarterly sampling of conventional parameters at 200 additional locations for 2 years. Many of these locations are co-located with AMNET network stations. Thus, through these efforts, significant additional water chemistry data will become available at AMNET locations. If exceedences of SWQS criteria are identified through these monitoring efforts, TMDLs will be developed as appropriate.



Identification of Factors that Contribute to Impairment: In order to better evaluate the many potential causes of benthic impairment, NJDEP and USGS are cooperatively conducting a study over the next 2 years: "Development of Watershed Indicators and Realistic Stream Restoration Goals". This study will build upon the work done in the LI-NJ NAWQA project, using statewide benthic data collected in NJDEP's AMNET program and include advanced statistical and spatial analyses using many datasets to identify factors that contribute to benthic impairment. Factors that will be considered include point sources, golf courses, lake outlets, contaminated sites, landfills, stream flow, habitat quality, water quality, sediment quality, etc.

Field Investigations: The Watershed Indicators project described above includes the development of a "Watershed Characteristics Data Sheet" to provide a coordinated mechanism for recording information relevant to characterizing potential causes of benthic impairment. NJDEP's Water Compliance and Enforcement, Division of Watershed Management and Watershed Partners are conducting watershed stream walks to identify potential causes of impairment such as erosion, storm drains, etc.

Evaluation of Stations With Changes in Impairment Rating: Additional investigations and data assessments are needed to evaluate the apparent changes in biological health as reflected in AMNET scoring changes between 1990 and 1998 (16% of sites with a negative change, 13% with positive change). The Watershed Indicators project described above will include an evaluation of changes in watershed characteristics that may be related to changes in impairment rating.

Targeting Nonpoint Source Management (319h) Grants: The (319h) funding source provides over \$3 million for Nonpoint Source Management Projects. This year, funding criteria for 319h grants included the identification of impairments to be addressed and the targeting of management measures to address these impairments. To the extent possible, projects are being targeted toward impairments identified through the AMNET monitoring program.

Future Strategies: As the Water Quality and Watershed Management Rules and Municipal Stormwater Management and Permitting programs are developed and implemented, improvements in management of stormwater flows, erosion and sedimentation are expected as new development occurs. In already developed areas, cross-connections and interconnections between sewage and stormwater infrastructure will be investigated and remediated.

**Table 3.2.2-2: Comparative Scores / Ratings (see notes),  
Watershed Management Areas 1, 2, and 11**

Station	NJ Impairment Score		Change in Rating	Habitat Score		Station	NJ Impairment Score		Change in Rating	Habitat Score		Station	NJ Impairment Score		Change in Rating	Habitat Score	
	92 / 93	97 / 98					92 / 93	97 / 98					92 / 93	97 / 98			
001	9	9	/	97		040	24	21	—	155		081	27	30	/+	165	
002	18	21	/+	140		040A	-	18		162		082	30	30	/	171	
003	30	24	/-	167		041	30	30	/	156		083	24	30	/+	148	
004	30	30	/	194		042	0	21	+	98		084	21	21	/	144	
005	27	30	/+	162		043	30	27	/-	148		085	24	18	—	136	
005A	-	30		143		044	15	15	/	146		086	21	30	+	151	
006	30	30	/	170		045	30	30	/	113		087	27	24	/-	146	
007	30	30	/	184		046	30	24	/-	133		088	24	30	/+	148	
008	30	30	/	177		047	27	30	/+	165		089	30	30	/	138	
009	30	30	/	182		048	27	30	/+	163		090	9	15	/+	168	
010	-	30		196		049	30	30	/	147		091	24	21	—	165	
011	30	27	/-	183		050	30	30	/	159		092	21	21	/	163	
012	30	30	/	163		051	30	30	/	156		093	27	9	—	170	
013	-	-		-		052	27	24	/-	97		094	30	30	/	168	
014	21	30	+	146		053	9	24	+	116		095	30	24	/-	168	
015	18	15	/-	141		054	30	30	/	180		096	27	27	/	166	
016	27	15	—	147		055	12	15	/+	133		097	24	24	/	166	
017	18	24	+	107		056	30	30	/	147		098	30	30	/	166	
018	18	18	/	105		057	21	21	/	121		099	21	18	/-	141	
019	27	18	—	118		058	27	27	/	158		100	27	24	/-	144	
020	24	-		-		059	15	30	+	156		101	18	27	+	166	
021	30	30	/	171		060	30	30	/	146		102	24	27	/+	170	
022	15	18	/+	168		061	30	24	/-	120		103	18	30	+	166	
023	21	-		-		062	18	21	/+	124		104	9	18	/+	162	
023A	-	30		186		063	18	30	+	170		105	30	24	/-	166	
024	30	30	/	140		064	27	30	/+	181		106	24	24	/	140	
025	30	27	/-	144		065	24	27	/+	177		107	24	24	/	145	
026	24	27	/+	98		066	27	27	/	173		108	6	9	+	158	
027	21	30	+	87		067	24	30	/+	107		109	24	9	—	167	
028	30	30	/	182		068	24	21	—	123		109A	-	12		155	
029	30	30	/	146		069	30	30	/	148		109B	-	15		152	
030	15	21	/+	95		070	18	15	/-	165		110	6	12	+	147	
031	30	30	/	142		071	27	30	/+	159		111	6	12	+	128	
032	27	18	—	185		072	27	15	—	176		112	6	12	+	127	
032A	-	30		155		073	24	30	/+	185		113	3	15	+	132	
033	30	27	/-	155		074	30	27	/-	184		114	15	18	/+	121	
034	30	-		-		075	30	30	/	174		115	12	15	/+	92	
035	18	12	/-	127		076	30	30	/	176		115A	-	18		131	
036	24	9	—	126		077	27	30	/+	85		116	15	15	/	122	
037	30	30	/	164		078	30	30	/	171		117	0	6	/+	139	
038	24	21	—	144		079	21	30	+	146		118	12	9	/-	104	
039	27	27	/	149		080	30	30	/	180		294	30	21	—	164	

**NOTES:**

Station # 001 - 074, inclusive, lie in WMA 1; stations 075 - 118 lie in WMA 11. Station 294 - 309A lie in WMA 2.

Comparison of NJ impairment score with earlier study results:

+ indicates positive change in rating

— indicates negative change in rating

/ indicates no change in rating

/+ or -/ indicates change in score, but not in rating

NJ Impairment Score   Value  
Non-Impaired   24 - 30  
Moderately Impaired   9 - 21  
Severely Impaired   0 - 6

Habitat Score   Value  
Optimal   160 - 200  
Sub-optimal   110 - 159  
Marginal   60 - 109  
Poor   < 60

**Table 3.2.2-2** (continued)

**Comparative Scores / Ratings** (see notes)

**Watershed Management Areas 1, 2, and 11**

Station	NJ Impairment Score		Change in Rating	Habitat Score		Station	NJ Impairment Score		Change in Rating	Habitat Score		Station	NJ Impairment Score		Change in Rating	Habitat Score	
	92 / 93	97 / 98					92 / 93	97 / 98					92 / 93	97 / 98			
295	-	21		135													
296	-	9		148													
297	18	21	/+	191													
298	27	18	—	142													
299	24	18	—	174													
300	27	15	—	163													
301	18	21	/+	141													
302	24	21	—	156													
303	30	30	/	193													
304	21	12	/-	122													
305	27	27	/	184													
306	30	21	—	190													
307	30	18	—	90													
308	27	18	—	167													
309	18	15	/-	113													
309A	-	30		196													

**NOTES:**

Station # 001 - 074, inclusive, lie in WMA 1; stations 075 - 118 lie in WMA 11. Station 294 - 309A lie in WMA 2.

Comparison of NJ impairment score with earlier study results:

- + indicates positive change in rating
- indicates negative change in rating
- / indicates no change in rating
- /+ or -/- indicates change in score, but not in rating

<u>NJ Impairment Score</u>	<u>Value</u>	<u>Habitat Score</u>	<u>Value</u>
Non-Impaired	24 - 30	Optimal	160 - 200
Moderately Impaired	9 - 21	Sub-optimal	110 - 159
Severely Impaired	0 - 6	Marginal	60 - 109
		Poor	< 60